# ECOLOGICAL STUDIES OF WILLOW (*SALIX CAROLINIANA*): MONTHLY STATUS REPORT #3

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# Ecological Studies of Willow (*Salix caroliniana*): Monthly Status Report #3 Covering the time period from March 1-31, 2009

This status report summarizes progress made on the Ecological Studies of Willow project through March 31, 2009, with reference to the tasks and timeline outlined in the Scope of Work and presented in Table 1 below.

**Table 1.** Timeline of tasks to be accomplished in Year 1 and later. Tasks initiated and underway in this reporting month are highlighted in blue.

YEAR 1

| Quarter | Months | Tasks accomplished |
|---|---|---|
| 1st | Oct – Dec, 2008 | Initiate and complete Task 1 (*Finalize research plan*) |
| 2nd | Jan – Mar, 2009 | Initiate Task 2.1 (*Germination & early survival and growth experiments*)<br>Initiate Task 2.4 (*Life history*) |
| 3rd | Apr – Jun, 2009 | Continue Task 2.1 (*Germination experiment*)<br>Initiate Task 2.2 (*Willow transplantation*)<br>Initiate Task 2.3 (*Fire response*)<br>Continue Task 2.4 (*Life history*) |
| 4th | Jul – Sep, 2009 | Continue Task 2.4 (*Life history*)<br>Complete Tasks 2.1 & 2.2 (*Germination experiment & Willow transplantation*)<br>Complete Task 3.1 (*Data analysis and final report, Year1*) |

YEAR 2

| Quarter | Months | Tasks accomplished |
|---|---|---|
| 1st | Oct – Dec, 2009 | Continue Task 2.3 (*Fire response*)<br>Continue Task 2.4 (*Life history*) |
| 2nd | Jan – Mar, 2010 | Continue Task 2.3 (*Fire response*)<br>Continue Task 2.4 (*Life history*)<br>Initiate Task 2.5 (*Spatial analysis of willow distribution*) |
| 3rd | Apr – Jun, 2010 | Initiate Task 2.2 (2nd iteration, *Willow transplantation*)<br>Continue Task 2.3 (*Fire response*)<br>Continue Task 2.4 (*Life history*)<br>Continue Task 2.5 (*Spatial analysis of willow distribution*) |
| 4th | Jul – Sep, 2010 | Complete Task 2.2 (2nd iteration, *Willow transplantation*)<br>Continue Task 2.3 (*Fire response*)<br>Continue Task 2.4 (*Life history*)<br>Continue Task 2.5 (*Spatial analysis of willow distribution*)<br>Complete Task 3.2 (*Data analysis and final report, Year2*) |

**Progress on Task 1 – Finalizing the Research Plan**
The UCF team modified the planned competition experiment, per recent e-mail discussions with Dianne Hall. We will select field sites in the southern region next week.

**Progress on Task 2.1 – Germination and Early Survival and Growth Experiments**
The UCF team completed one growth chamber experiment to identify optimal conditions for willow germination (Fig. 1).

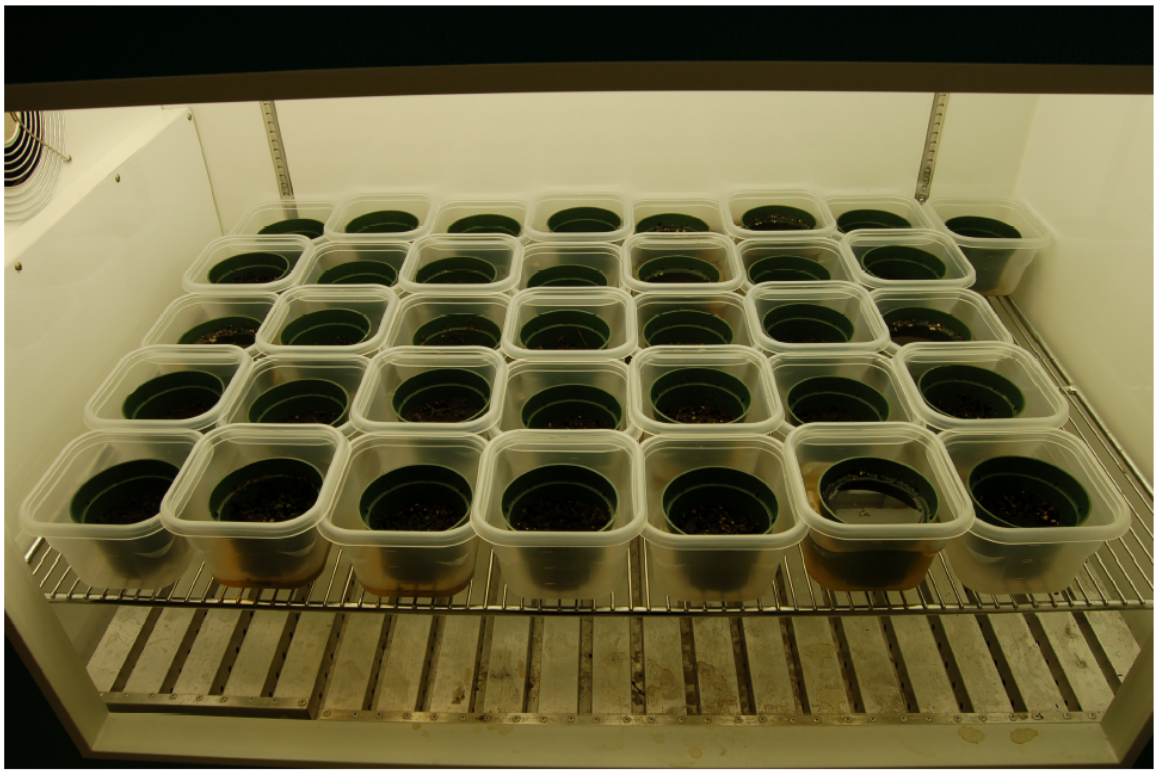

**Fig. 1.** First germination experiment in the growth chamber.

Six treatments were established, with pots containing commercial potting soil either

1. Continuously flooded (5 cm above the soil surface)
2. Kept moist by capillarity (always 2 cm with water in the outside container)
3. Watered daily
4. Watered once every three days
5. Watered once every five days
6. Watered once every eight days but growing on sand rather than potting soil

Willow seedlings had the lowest mortality in Treatment 2: soil kept moist by capillarity, with 2 cm water in the outside container (Fig. 2). Mortality was significantly higher in Treatment 6 than in all other treatments, illustrating the difficulty that willow has establishing on sandy soil under dry conditions. Mortality in the remaining four treatments was intermediate between these two extremes (Fig. 2).

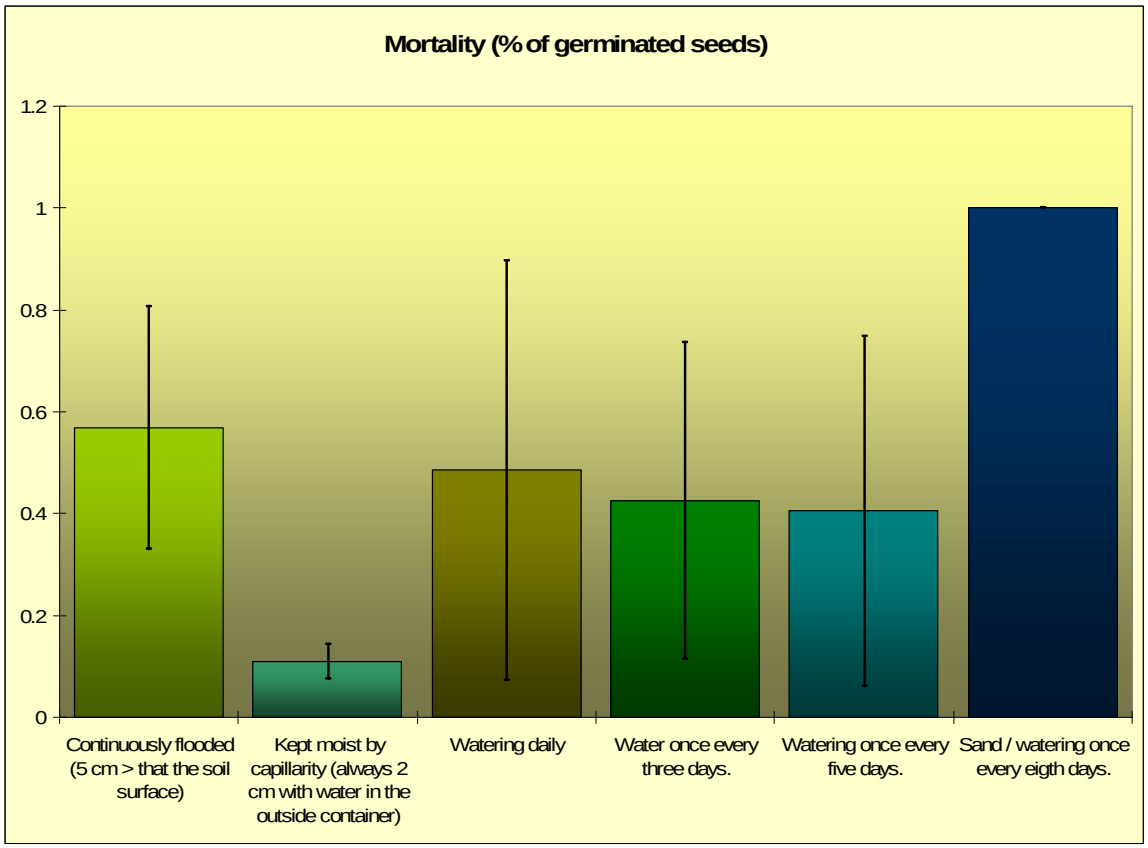


**Fig. 2.** Mean (± 1 SE) mortality of willow seeds under different soil and watering regimes within a growth chamber. Mortality was lowest when soil remained moist from capillary action, and highest on sandy soil with infrequent watering.

During the course of this experiment, we learned that green seeds are viable and that brown seeds usually are inviable, so willow seeds must be carefully sorted before beginning an experiment (Fig. 3).

**Fig. 3.** Dr. Quintana-Ascencio isolating viable green willow seeds.

Usually, 100% of green seeds are viable (Fig. 4, top). We also observed seeds that sank to the bottom of containers with cotyledons extended and elongating their stem to the surface; and floating seeds with cotyledons at the surface extending a root toward the bottom (Fig. 4, bottom). The latter look similar to duckweed and may easily be mistaken for it in the field.

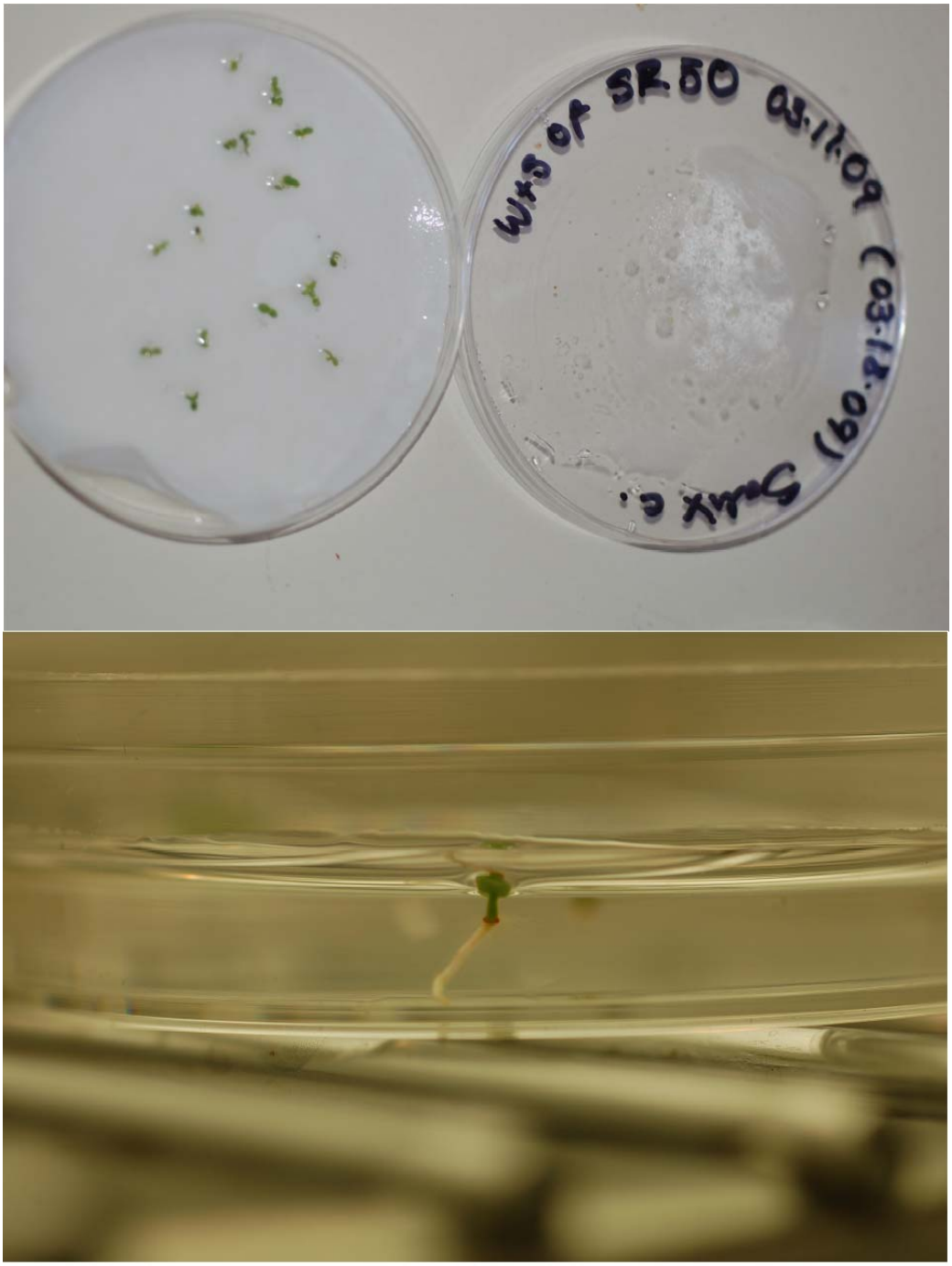

**Fig. 4.** (Top) Nearly 100% of green willow seeds are viable. (Bottom) A willow seedling with cotyledons barely emerged and floating on the surface, sending its root toward the bottom. The size, color and orientation of floating willow seedlings are similar to duckweed.

During this month, we initiated a second germination experiment using the six soil types used in the greenhouse experiment. Thirty green seeds were sown into each pot. These are being maintained in the growth chamber with water delivered by capillary action, which is the optimal treatment identified in the previous experiment (Fig. 2). Results of this experiment will become available at the end of April. Initial observations suggest there is variation in survival of willow seedlings among soils.

**Progress on Task 2.2 – Willow Transplantation**

The UCF team measured and potted all of the cuttings that will be used in field experiments (Fig. 5). We also germinated seedlings for the field experiment. One set of cuttings and seedlings was deployed last week, in the island experiment.

**Fig. 5.** (TOP) Graduate students in Dr. Quintana-Ascencio's restoration ecology class measured and potted cuttings for the field experiments. (Bottom) Willow cuttings potted, measured, uniquely numbered, and ready for transplanting into field experiments. Each flag color represents a different collection region; blue = northern, green = north-central, yellow = south-central and pink = southern.

**Progress on Task 2.4 - Life History**

We continued to collect data on willow growth forms and fecundity. As before, we identified individual willow plants (ramets) based on gender, which we identified from their flowers, and continuity of trunks. We then counted the number of trunks, measured their diameter, and selected one trunk at random. We next determined the number of branches, chose one at random, and so on, continuing in this manner until the near-terminal branch was reached. We then counted the number of flowers on all terminal branches arising from it, and the number of seeds per flower for female plants. We made this slight procedural change because some terminal branches did not bear flowers; our new protocol averages across a large number of terminal branches, making the estimate more accurate (i.e., less likely to be zero because a non-flower bearing branch was chosen at random). From this information, we estimated the fecundity of the entire plant.

We currently have life history and fecundity data for 49 willow plants, including roughly equal numbers of male and female plants.

**Progress on Task 2.5 – Spatial Analysis of Willow Distribution**.

We again concentrated on preparing plants for the field experiments and collecting fecundity data and therefore did not complete any additional formal work on the spatial model.

**Summary of Activity**

During this reporting period, the UCF team logged more than 22 person-days collecting willow seeds, sowing them, and preparing for the experiments (Table 1). Twenty person days is equivalent to a full-time position. Copies of our data notebooks and spreadsheets were sent today electronically, as PDF and Excel files, respectively.

**Table 1.** Dates of field trips and other major activities during this reporting period. Not included in this list are routine activities such as watering plants and monitoring those in the growth chamber.

| Date | Work performed | Purpose |
|---|---|---|
| 03/05/09 | SJRWMD staff | Site visit to UCF |
| 03/18/09 | UCF graduate students | Collection of willow seeds and sorting |
| 03/19/09 | | Collection of willow seeds and sorting |
| 03/24/09 | UCF graduate students | Collection of fecundity data |
| 03/27/09 | SJRWMD staff | Identifying field site for island experiment |
| 03/31/09 | UCF graduate students | Measuring cuttings for field experiments |